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a complex of eight clusters of true antheridia in the form of filaments, and the entire structure constitutes a sorus-like structure in which the antheridial filaments arise endogenously. This conception has strong support in the abnormal conditions described by Ernst for *Chara syncarpa* where antheridial filaments were found developing externally from cells below the oogonium giving an hermaphrodite association of sexual organs. Schenck considers the Charales to be much more closely related to the brown algæ than to the green, basing his views on the above considerations together with certain resemblances between their vegetative structure (characterized by nodal and internodal regions) and that of certain brown algæ, *Spermatococcus*, *Desmarestia*, etc.

BRADLEY M. DAVIS.

HOLOTHURIANS

Clark's The Apodous Holothurians.¹—Revisions of genera and larger groups require more painstaking care and research than most other forms of biological study, certain current opinion to the contrary, notwithstanding. Dr. Clark's memoir is a good example of a revision applied to a difficult group of animals. It is a well-executed and well-matured piece of work, and one which fulfills all reasonable expectations. It is easily the most important treatise that has ever been published upon the families Molpadiidæ and Synaptidæ.

The monograph is based upon a critical examination of about 2,200 specimens in the collection of the National Museum, and is divided into four parts. The classification of the two families is first discussed and a table of accepted genera, with type species, is given. Part II is an annotated list of the species in the collection of the National Museum, including descriptions of new genera and species. Part III contains an account of the Synaptidæ, their morphology, embryology, physiology, ecology and taxonomy, with keys to genera and species, and a short notice of each species, special attention being given to the geographical distribution. In Part IV, the Molpadiidæ are treated in a similar manner. Of the thirteen plates, three are

¹The Apodous Holothurians, A Monograph of the Synaptidæ and Molpadiidæ, Including a Report on the Representatives of these Families in the Collections of the United States National Museum. By Hubert Lyman Clark. Smithsonian Contributions to Knowledge, Part of Vol. XXXV, 231 pp., XIII plates, 1907 (issued early in 1908).

in color. The figures are intended to illustrate not only the new forms described, but also previously known species that have not been figured and some others, figures of which will be of service to the student. In a number of instances the nomenclature has been changed, and has been placed on as firm a basis as possible by the use of the generally accepted principles of the International Code. It will be seen that the monograph has a wider scope than a systematic revision, including as it does accounts of the anatomy, embryology and physiology.

The interesting account of the history of the classification of the two families is followed by an important consideration of the characters used in classification, and a discussion of the subfamilies and leading genera. Twenty-nine genera, of which 8 are new, are accepted, distributed as follows: Synaptinæ, 11 genera (2 new) comprising 60 species; Chiridotinæ, 7 genera (3 new) with 22 species; Myriotrochinæ, 3 genera, 6 species; Molpadiidæ, 8 genera (3 new and 1 new name) with 46 species. Dr. Clark has discovered that Ankyroderma is practically a juvenile condition of Trochostoma. As generally defined the former is distinguished from the latter by the presence of rosettes of racquet-shaped rods from the center of which there extends outward a conspicuous anchor. It was found, from a study of more than 350 specimens of these two genera, that the presence of anchors and rosettes of racquet-shaped rods can not be regarded as even a constant specific character. For example, small specimens of *Trochostoma intermedium* Ludwig with very thin skin are clearly Ankyroderma. Large specimens have a rather thick body wall and very numerous deep red or brown bodies in the skin, but no rosettes. The rosettes disintegrate into heaps of rounded colored bodies which differ from calcareous plates or particles in being chiefly phosphoric acid and iron. They are therefore quite unlike the ordinary calcareous deposits of holothurians, and are named "phosphatic deposits."

"As to the significance of these facts our knowledge is as yet too imperfect to draw any clear conclusions. Chemical analysis² of the

²The composition of these bodies is given as $\text{FePO}_3 + 4\text{H}_2\text{O} = 66.2$, $\text{Fe}(\text{OH})_3 = 20.2$ and $\text{CaCO}_3 = 6.4$. There is also probably Mg present. "There is also reason to believe that the amount of CaCO_3 is subject to much variation; probably when calcareous particles are first transformed into colored bodies, CaCO_3 is the most important substance present, and

deposits shows that the colored bodies are radically different from the ordinary deposits in the skin. Both are possibly connected with the process of excretion; but why one should replace the other it is certainly hard to say. That the change is closely connected with the age of the individual seems to me almost certain, though it must be remembered that size in echinoderms is not a sure criterion of age. It is interesting to note that most of the species of *Ankyroderma* described have been less than 60 mm., while many of the *Trochostomas* range over 75" (p. 19).

The name *Trochostoma* antedates *Ankyroderma*, but both are synonyms of Cuvier's *Molpadia* (1817) which includes also *Haplodaetyla* Grube (not Semper), as well as the long-discarded *Embolus* Selenka, and *Liosoma* Stimpson (not Brandt). In this enlarged genus *Molpadia*, twenty-seven species are recognized.

Some of the more important changes in the limits or names of genera, as well as certain new genera, will be noted. *Synapta* is monotypic and restricted to *S. maculata* Chamisso and Eysenhardt (*S. beselii* authors); Oestergren's *Chondroclæa* is called by the older name *Synaptula*; *Leptosynapta* Verrill is reinstated for the *inharens* group; *Synapta kefersteinii* is made the type of a new genus *Polyplectana*; the recently described *Opheodesoma* is accepted for the *Euapta glabra* group; the old species *Chiridota rufescens* is made the type of a new genus *Polycheira*; *Taniogyrus* Semper, for *Chiridota australiana* Stimpson, is accepted as distinct from the later *Trochodota* Ludwig; *Chiridota japonica* v. Marenzeller is made the type of *Scolidota*, new; *Achirodota* is founded upon *Anapta inermis* Fisher, and *Toxodora* Verrill is reinstated. The most important change in the *Molpadiidæ* has already been noted. *Haplodaetyla* Semper 1868 (not Grube, 1840) is renamed *Aphelodaetyla*, with five species. *Ceraplectana* and *Himasthlephora* are two new genera, the former near *Molpadia*, the latter related to *Gephyrothuria* Koehler and Vaney.

It has occurred to the present reviewer that, had space permitted, a very useful feature would have been the insertion of a complete diagnosis under each species not described in Part II. It is not possible to include in keys all the positive characters of a species, nor is it always possible for the average as the color deepens, it decreases rapidly in amount. Apparently the calcium as well as the CO₂ is excreted as these changes take place" (p. 143). The presence of phosphatic deposits is limited to the *Molpadiidæ* among echinoderms.

student to have access to original descriptions. No one is able to tell when an apparently useless character (from the systematist's standpoint) and therefore one invariably omitted from keys, may not assume prime importance in the light of unnamed material. The practical difficulty that one has in depending upon literature and concise revisions is this. By testimony of keys (and figures too) one may have a species very close to a named species, yet there may be present in the questionable form additional characters of which no mention is made in keys. If one has not access to the original or some later authentic description he is "up a stump." The writer has so often found himself in this undesirable position that he speaks with some feeling on the subject.

However, the lack of descriptions is partly compensated for by the excellent notes under "Remarks," and in some cases by the republication of figures. Students of the group have every reason to be grateful to Dr. Clark for a very timely and useful memoir, and one which has in several instances reduced to order what was seemingly hopeless chaos.

W. K. FISHER.

LEPIDOPTERA

The Blue Butterflies of the Genus *Celastrina*.—In the second volume of Mr. J. W. Tutt's "British Butterflies," recently published, is a most exhaustive account of the small blue butterflies represented in Europe by *Celastrina* (vel *Cyaniris*, vel *Lycana*) *argiolus*, and in America by the common and widely distributed *C. pseudargiolus*. The latter insect has long attracted much attention, owing to its remarkable polymorphism, which has been elucidated very fully by Edwards and Seudder. Mr. Tutt has gone over the whole subject afresh, and with the assistance of Dr. T. A. Chapman and Mr. G. T. Bethune-Baker, has been able to reach a number of very interesting conclusions. It appears that *Celastrina* is essentially an old world type: found, or represented by close allies, in every one of the great zoological regions of the Eastern Hemisphere, though feebly represented in Australia and Africa. In America, it is represented by *C. pseudargiolus* and its subspecies, one of which extends as far south as Panama. An examination of the structural characters, especially the genitalia, shows that *pseudargiolus* is not in any way definitely separable from the palaearctic *argiolus*, of which it must be considered a geographical race. It appears probable